

Quick Reference Guide for the HP 3326A Two-Channel Synthesizer



INTRODUCTION

This programming note is a reference guide for the remote operation of the HP 3326A Two-Channel Synthesizer. This note is intended for use by those familiar with HP-IB programming and the basic functions of the HP 3326A Two-Channel Synthesizer. For complete programming information refer to the HP 3326A Operating Manual.

INPUT DATA

The 3326A Two-Channel Synthesizer accepts programming codes that contain information for programming all of the front panel and special HP-IB only functions except the Line switch and Set HP-IB Address. The programming data

string consists of a string of ASCII coded characters composed of one or more of the following control fields:

- Channel Select
- Entry Select
- Function Select
- Sweep Mode
- Mode Select
- Modulation
- Instrument State/Registers
- Calibration
- Special HP-IB Only Functions

Input Syntax. The 3326A responds to program codes in the order in which they are received. Each event or performed action is programmed with a string of ASCII coded characters that follow one of the following sequences.

- **Numeric Entry:**
[Entry Prefix] [Numeric Value] [Numeric terminator]
- **Select Value/Mode:**
[Entry Prefix] [Numeric Value]
- **Immediate Action:**
[Action Code]

NOTE

The HP-IB program code sequence typically mirrors that of the local front panel keystroke sequence, except the shift functions which have special HP-IB codes.

Entry Prefix/Action Codes. Entry prefix/action codes are typically 2 to 5 character mnemonics. For an entry that has a numeric value associated with it, programming the entry prefix code only will enable and activate the numeric display of the current value.

Numeric Values/Formats. These are either a single decimal digit, a set of 14 characters or less representing a number, or a string of binary bytes. A string of 15 characters maximum can be expressed in exponential, decimal, or integer form. Acceptable numeric formats are referenced in later sections by the following format syntax:

Format #1: Exponential	$\pm d^{***}d.d^{***}dE \pm dd$
Format #2: Decimal	$\pm d^{***}d.d^{***}d$
Format #3: Integer	$\pm d^{***}d$
Format #4: Single Digit	d
Format #5: Binary String	b^{***}b

The character 'd' indicates a leading or trailing zero, a space, or a numeric digit (0 through 9). The character 'b' indicates an 8-bit binary byte. The characters '***' indicate a variable number of the previous character. Numeric values are scaled by the appropriate numeric terminator. Negative signs are ignored and the positive value used if the parameter can not have negative values.

Numeric Terminators. Numeric terminators are multi-character codes that terminate and scale the associated numeric value. Thus, frequency values can be entered in MHz (MHZ), kHz (KHZ), or Hz (HZ); sweep time values can be entered in seconds (SEC) or milliseconds (MS); amplitude values can be entered in dBm (DBM), dBV (DBV), Volts peak-to-peak (VO), Volts RMS (VRMS), millivolts peak-to-peak (MV), or millivolts RMS (MR); phase in degrees (DEG); and modulation level in % AM (PC) or degrees PM (DEG).

Valid Characters. The valid characters in program codes can be either upper or lower case characters (A-Z, a-z) since they can be interchanged, digits (0-9), decimal point (.), plus/minus signs (+, -), question mark (?), and pound sign (#). The parity bit (ie. 8th bit) is ignored by the 3326A.

Delimiters. All alpha programming codes must be delimited by a non-valid character (ie. space, comma, semicolon) for that action to be activated and the next event processed. If a valid character is used, a syntax error will occur.

Programming Data. The 3326A buffers up to 3 or 100 characters of HP-IB data, depending on the bus mode selected. Thus care must be taken to ensure a desired action has occurred. This can be accomplished via the WAIT command or a serial poll of the status byte ready bit.

Table 1 lists all Input Programming Codes and their syntax.

Instrument Preset. Instrument Preset turns off all functions then sets the following:

- **Channel A:**
 - Frequency 1000 Hz
 - Amplitude 100 mV pp
 - DC Offset 0 V
 - Phase 0 deg
 - Function sine
 - Start Frequency 0 Hz
 - Stop Frequency 13 MHz
- **Channel B:**
 - Frequency 1000 Hz
 - Amplitude 100 mV pp
 - DC Offset 0 V
 - Phase 0 deg
 - Function sine
 - Start Frequency 0 Hz
 - Stop Frequency 13 MHz
- **Mode** Two Channel
- **Duty Cycle** 50%
- **Modulation Level** 30% (AM)
- **Marker Frequency** 6.5 MHz
- **Marker Channel** Channel A
- **Sweep Time** 1 sec
- **Sweep Mode** Ramp
- **Calibration Mode** Internal
- **Channel Selected** A
- **Trigger Action Pending** Single Sweep

Instrument Preset does not affect the Storage Registers, HP-IB address, or Service Request Mask value.

OUTPUT DATA

The 3326A has several output modes that allow the user to learn and interrogate the present instrument state. The following output modes are available:

- Learn String
- Interrogate Parameter
- Interrogate Error

All messages are terminated by asserting the bus EOI signal in parallel with the last byte of the message to be sent.

Learn String: Selected with the "LRN" program code, the 3326A outputs a Learn String of 172 bytes in length. This binary data string completely describes the present instrument state saved in the specified Storage Register of the 3326A. The information is packed and encoded for minimal storage requirements thereby making data analysis difficult. When stored in an ASCII character data string, the Learn String can later be input to any Storage Register of the 3326A to save that instrument state (see Table 1 for Learn String information). The length of the Learn String is fixed, independent of the functions selected.

Format: 172 [8 bit bytes] [EOI]

Interrogate Parameter: Selected with the "I" preceding the program code for the parameter to be interrogated, or a "?" following the program code, the 3326A will output an ASCII string composed of the parameter code, present numeric value, and units. The numeric value indicates either the present status, mode or value. Values are expressed in fundamental units, ie. Hz, seconds, volts, degrees, and %. Table 1 also lists the output format for each valid parameter to interrogate.

Format: [program code] [numeric value] [units] [CR] [LF] [EOI]

Interrogate Error: Selected with the "ERR?" program code, the 3326A outputs a numeric value corresponding to the most recent error number. Table 3 lists the possible error numbers and their causes.

Format: [numeric value] [CR] [LF] [EOI]

TRIGGER

The 3326A responds to HP-IB Commands Group Execute Trigger (GET) and Selective Device Trigger (SDT) depending upon the last trigger action command. Receipt of either command causes the 3326A to perform an action specified by the Trigger Action command.

CLEAR

The 3326A responds to both Device Clear (DCL) and Selective Device Clear (SDC) by clearing all bits of the status byte then setting bit 4 (Ready for Data), clearing the HP-IB command buffer, and initializing the interface so that it is ready to receive HP-IB programming codes. This is necessary if the instrument state prior to sending HP-IB commands is unknown. It is good practice to execute DCL or SDC at the beginning of any program.

REMOTE/LOCAL CHANGES

The 3326A goes to the Remote state when the LREN line is true (low) and the 3326A receives its listen address. In Remote, all front panel functions are disabled except the LINE switch and the LOCAL key. The LOCAL function can also be disabled via the Local Lockout (LLO) command.

The 3326A goes to the Local state when it receives the Go To Local (GTL) command or when the LREN line is set false (high). If the Local Lockout (LLO) command has not been executed, the 3326A can also be set to Local by pressing the LOCAL key. In Local, the front panel is active but the instrument will still respond to HP-IB programming codes.

SERVICE REQUEST

The 3326A can initiate a Service Request (SRQ) whenever one of the following conditions exists:

- Programming error (syntax, incompatible mode, etc.)
- Sweep in progress
- Hardware error
- Ready for data
- Power Failure/On

Further information can be obtained by conducting a Serial Poll, which accesses the Status Byte. The SRQ is cleared only by executing a Serial Poll. To select an SRQ for a particular set of circumstances, the Request Mask function can be used to determine which of the bits in the Status Byte can cause an SRQ. The mask value is determined by summing the decimal values of each selected function/condition that is desired. The default Request Mask at power on is "00000000" or decimal 0. The mask value is reset to the default value only at power on or by the front panel memory clear function.

STATUS BYTE

The 3326A responds to a Serial Poll by sending its status byte as indicated in Table 2. When Bit 6 (Request Service) of

TABLE 1. HP3326A HP-IB MNEMONIC SUMMARY

	Front Panel Control	Mnemonic	Range	Suffix	Interrogation Response	Description Resolution Syntax
CALIBRATION BLOCK						
	AUTO	ACAL	0-1	—	—	AutoCALibration Syntax: "ACAL0" "ACAL OFF"
		or ACAL	—	OFF, ON		
	MANUAL	CAL	—	—	—	CALibrate Syntax: "CAL"
	SELECT	CMD	1	—	—	Calibration MoDe - INTernal Syntax: "CMD1" "CMD INT"
		or CMD	—	INT		
		CMD	2	—	—	Calibration MoDe - EXTernal Syntax: "CMD1" "CMD EXT"
		or CMD	—	EXT		
		CMD	3	—	—	Calibration MoDe - MULTiphase Syntax: "CMD3" "CMD MULT"
		or CMD	—	MULT		
	SELF TEST	TST	—	—	#####	self TeST, each # = P or F for Pass or Fail Syntax: "TST"
ENTRY BLOCK						
	AMPTD	AM	0-10 V	VO, VRMS, DBM, DBV	AM ±#.###E ±##VO	AMplitude Resolution: 1 mV p-p Syntax: "AM1.125VRMS"
	ASGN ZERO ϕ	ZPH	—	—	—	Zero PHase Syntax: "ZPH"
	CLR ϕ OFS	COF	—	—	—	Clear phase OFFset Syntax: "COF"
	DC OFFSET	OF	± 5 V	VO	OF ±#.###E ±##VO	OFFset Resolution: 10 mV Syntax: "OF3.02VO"
	FREQ	FR	0-13 MHz	HZ, KHZ, MHZ	FR #####.#####HZ or FR #####.###HZ	FRequency Resolution: 1 μ Hz $f < 100$ kHz, 1 mHz $f \geq 100$ kHz Syntax: "FR7.5MHZ"
	PHASE	PH	± 720°	DEG	PH ±#.###E ±##DEG	PHase Resolution: 0.01° Syntax: "PH180.05DEG"
	DUTY CYCLE	DUTY	1-99%	PC	DUTY#.###E ±##PC	DUTY cycle Resolution: 0.01 % Syntax: "DUTY25.50PC"
	% AM/ PM DEV	ML or ML	0-100% 0-360°	PC DEG	ML ±#.###E ±##PC or ML ±#.###E ±##DEG	Modulation Level Resolution: 0.1 % or 1° Syntax: "ML30.5PC"

HP 3326A HP-IB MNEMONIC SUMMARY (Cont'd)

	Front Panel Control	Mnemonic	Range	Suffix	Interrogation Response	Description Resolution Syntax	
FUNCTION BLOCK							
	CHA	FCNA or FCNA	0 —	— OFF	—	FunCtioN channel A OFF Syntax: "FCNA0" "FCNA OFF"	
		FCNA or FCNA	1 —	— SIN	—	FunCtioN channel A SINe Syntax: "FCNA1" "FCNA SIN"	
		FCNA or FCNA	2 —	— SQR	—	FunCtioN channel A SQuaRe Syntax: "FCNA2" "FCNA SQR"	
		FCNA or FCNA	3 —	— DC	—	FunCtioN channel A DC Syntax: "FCNA3" "FCNA DC"	
	CH A HV	HVA or HVA	0-1 —	— OFF, ON	—	High Voltage channel A Syntax: "HVA1" "HVA ON"	
		CHB	FCNB or FCNB	0 —	— OFF	—	FunCtioN channel B OFF Syntax: "FCNB0" "FCNB OFF"
	FCNB or FCNB		1 —	— SIN	—	FunCtioN channel B SINe Syntax: "FCNB1" "FCNB SIN"	
	FCNB or FCNB		2 —	— SQR	—	FunCtioN channel B SQuaRe Syntax: "FCNB2" "FCNB SQR"	
	FCNB or FCNB		3 —	— DC	—	FunCtioN channel B DC Syntax: "FCNB3" "FCNB DC"	
	CH B HV	HVB or HVB	0-1 —	— OFF, ON	—	High Voltage channel B Syntax: "HVB1" "HVB ON"	
		BUS MODES					
			BUSM	1-2	—		BUS Mode Syntax: "BUSM2"
			WAIT	—	—	—	no operation Syntax: "WAIT"
	DISPLAY CONTROL						
			DISP or DISP	0-1 —	— OFF, ON	—	DISPlay control Syntax: "DISP1" "DISP ON"

HP 3326A HP-IB MNEMONIC SUMMARY (Cont'd)

	Front Panel Control	Mnemonic	Range	Suffix	Interrogation Response	Description Resolution Syntax
ERROR CODES						
		ERR?	—	—	ERR ###	ERRor code Syntax: "ERR?"
HP 3326A IDENTIFICATION						
		ID?	—	—	HP3326A	IDentification Syntax: "ID?"
		RDY?	—	—	0	ReaDY Syntax: "RDY?"
		REV?	—	—	####,####	REVision Syntax: "REV?"
		SER?	—	—	####A00000	SERial number Syntax: "SER?"
MODIFYING PARAMETERS						
		DN	—	—	—	Down increment by EINC value Syntax: "DN"
		EINC	see description		—	Entry INCrement for UP, DN, TUP, and TDN commands Use increment resolution and suffix appropriate for entry value modified Syntax: "EINC1HZ" "EINC.1VRMS"
		UP	—	—	—	UP increment by EINC value Syntax: "UP"
READING AND MASKING THE STATUS BYTE						
		MASK	0-255	PC	MASK###PC	SRQ MASK (weighted binary sum of bit po- sitions) Syntax: "MASK32PC"
SAVING OR RESTORING AN HP 3326A SETUP						
		LRN	0-9	—	—	LeaRN (read) nonvolatile memory Syntax: "LRN3"
		PRG	0-9	—	—	ProGram (restore) non- volatile memory Syntax: "PRG3"

HP 3326A HP-IB MNEMONIC SUMMARY (Cont'd)

	Front Panel Control	Mnemonic	Range	Suffix	Interrogation Response	Description Resolution Syntax
TRIGGERED OPERATION						
	STC	—	—	—	—	Sweep Triggered Continuous Syntax: "STC"
	STS	—	—	—	—	Sweep Triggered Single Syntax: "STS"
	TDN	—	—	—	—	Trigger Down increment by EINC amount Syntax: "TDN"
	TOFF	—	—	—	—	Trigger OFF Syntax: "TOFF"
	TUP	—	—	—	—	Trigger UP increment by EINC amount Syntax: "TUP"
INSTR STATE BLOCK						
	INSTR PRESET	RST	—	—	—	ReSeT Syntax: "RST"
	RCL DISCRETE	DRCL	00-62	—	—	Discrete ReCaLI element Syntax: "DRCL02"
	RECALL	RCL	0-9	—	—	ReCaLI memory Syntax: "RCL3"
	RST DISCRETE	CLR	—	—	—	Discrete sweep CLear elements Syntax: "CLR"
	SAVE	SAV	0-9	—	—	SAVe memory Syntax: "SAV3"
	SAVE DISCRETE	DSAV	00-62	—	—	Discrete SAVe element Syntax: "DSAV02"
MODE BLOCK						
	COMBINED	CMB or CMB	0-1 —	— OFF, ON	—	CoMBiner Syntax: "CMB1" "CMB ON"
	MODE	MODE or MODE	1 —	— TWOC	—	MODE TWO Channel Syntax: "MODE1" "MODE TWOC"
		MODE or MODE	2 —	— TWOP	—	MODE TWO Phase Syntax: "MODE2" "MODE TWOP"
		MODE or MODE	3 —	— TWOT	—	MODE TWO Tone Syntax: "MODE3" "MODE TWOT"
		MODE or MODE	4 —	— PULS	—	MODE PULSe Syntax: "MODE4" "MODE PULS"

HP 3326A HP-IB MNEMONIC SUMMARY (Cont'd)

	Front Panel Control	Mnemonic	Range	Suffix	Interrogation Response	Description Resolution Syntax
MODIFY BLOCK						
	ON/OFF	MFY or MFY	0-1 —	— OFF, ON	—	front panel ModiFY control Syntax: "MFY1" "MFY ON"
MODULATION BLOCK						
	none	NOM	—	—	—	NO Modulation Syntax: "NOM"
	CH A	AEA or AEA	0-1 —	— OFF, ON	—	Channel A External Amplitude modulation Syntax: "AEA1" "AEA ON"
		AEP or AEP	0-1 —	— OFF, ON	—	Channel A External Phase modulation Syntax: "AEP1" "AEP ON"
		AIA or AIA	0-1 —	— OFF, ON	—	Channel A Internal Amplitude modulation Syntax: "AIA1" "AIA ON"
		AIP or AIP	0-1 —	— OFF, ON	—	Channel A Internal Phase modulation Syntax: "AIP1" "AIP ON"
		SPE or SPE	0-1 —	— OFF, ON	—	Synchronous Phase modulation External Syntax: "SPE1" "SPE ON"
	CH B	BEA or BEA	0-1 —	— OFF, ON	—	Channel B External Amplitude modulation Syntax: "BEA1" "BEA ON"
		BEP or BEP	0-1 —	— OFF, ON	—	Channel B External Phase modulation Syntax: "BEP1" "BEP ON"
STATUS BLOCK						
	CHAN	CHA	—	—	—	select CHannel A Syntax: "CHA"
		CHB	—	—	—	select CHannel B Syntax: "CHB"

HP 3326A HP-IB MNEMONIC SUMMARY (Cont'd)

Front Panel Control	Mnemonic	Range	Suffix	Interrogation Response	Description Resolution Syntax
SWEEP BLOCK					
CONT	SC	—	—	—	Sweep, Continuous Syntax: "SC"
CNTR FREQ	CF	0-13 MHz	HZ, KHZ, MHZ	CF #####.#####HZ or CF #####.###HZ	Center Frequency Resolution: 1 μ Hz $f < 100$ kHz, 1 mHz $f \geq 100$ kHz Syntax: "CF10KHZ"
DISCRETE	SM or SM	3 —	— DSCR	—	Sweep Mode - DiSCReTe Syntax: "SM3" "SM DSCR"
MKR FREQ	MF	0-13 MHz	HZ, KHZ, MHZ	MF #####.#####HZ or MF #####.###HZ	Marker Frequency Resolution: 1 μ Hz $f < 100$ kHz, 1 mHz $f \geq 100$ kHz Syntax: "MF8.0MHZ"
MKR-> CF	CFM	—	—	—	Center Frequency equals Marker value Syntax: "CFM"
RESET SWP	SRE	—	—	—	Sweep REset Syntax: "SRE"
SINGLE	SS	—	—	—	Sweep Single Syntax: "SS"
SPAN	SPAN	0-13 MHz	HZ, KHZ, MHZ	SPAN#####.#####HZ or SPAN#####.###HZ	sweep frequency SPAN Resolution: 1 μ Hz $f < 100$ kHz, 1 mHz $f \geq 100$ kHz Syntax: "SPAN10MHZ"
START FREQ	ST	0-13 MHz	HZ, KHZ, MHZ	ST #####.#####HZ or ST #####.###HZ	STart frequency Resolution: 1 μ Hz $f < 100$ kHz, 1 mHz $f \geq 100$ kHz Syntax: "ST3.567891KHZ"
STOP FREQ	SP	0-13 MHz	HZ, KHZ, MHZ	SP #####.#####HZ or SP #####.###HZ	StoP frequency Resolution: 1 μ Hz $f < 100$ kHz, 1 mHz $f \geq 100$ kHz Syntax: "SP7.1E6HZ"
TIME	STIM	5 ms-1000 s	SEC, MS	STIM \pm #.####E \pm #SEC	Sweep TIME Resolution: 1 MS Syntax: "STIM.3MS"
TRIANGLE	SM or SM	1 —	— RAMP	—	Sweep Mode - linear RAMP Syntax: "SM1" "SM RAMP"
	SM or SM	2 —	— TRGL	—	Sweep Mode - linear TRianGLE Syntax: "SM2" "SM TRGL"

the Status Byte is true (one), an SRQ has occurred. See *Service Request* for the conditions causing a Service request. All other bits (0-5,7) indicate the present status of the noted function. The bits are true (one) only if the associated function/condition is true.

STATUS BIT

The 3326A does not respond to a Parallel Poll.

PASS CONTROL

The 3326A does not have the ability to take or pass control.

ABORT

The 3326A responds to the Abort message (Interface Clear - IFC true) by stopping all Listener or Talker functions.

ADDRESS ASSIGNMENT INFORMATION

The 3326A basic address is factory preset to decimal 18. In the Local mode, this address can be changed from the front panel by pressing the SHIFT and then the LOCAL keys. The display will show the current address; a new one can be entered via the 3326A keyboard.

Table 2: Status Byte Description

Status Byte Bit Numbers: B7 B6 B5 B4 B3 B2 B1 B0		
BIT NUMBER	DECIMAL VALUE	DESCRIPTION
B7	128	POWER RESTORED. Set when power is restored to the HP 3326A after power is interrupted. Reset when the HP 3326A is preset or receives a device clear, selected device clear, or RST command.
B6	64	REQUIRE SERVICE. Set when the HP 3326A requires service (sent an SRQ). Cleared along with the SRQ line when a serial poll is performed. It is also cleared when the condition causing the SRQ is removed.
B5	32	ERROR. Set when either a program or hardware error condition exists for the HP 3326A. Reset when the HP 3326A is preset, or receives a device clear command, selected device clear command, RST command, or when the error register is read with the IERR or ERR? HP-IB command.
B4	16	READY. Set when the HP 3326A has executed the last HP-IB command and is ready for the next command. Reset when the HP 3326A receives a device dependent command, device clear command, selected device clear command, or trigger.
B3	8	HARDWARE ERROR. Set when the HP 3326A detects an internal failure. Reset with an INSTR PRESET, device clear command, selected device clear command, RST command, or when the error register is read with the IERR or ERR? HP-IB command.
B2	4	SWEEP START/IN PROGRESS. Set when the HP 3326A starts a sweep. Reset when the sweep is stopped (either by reaching the stop frequency or aborted by a front panel or HP-IB command). It is also reset when the HP 3326A is preset or receives a device clear command, selected device clear command, or RST command.
B1	2	SWEEP STOPPED. Set when the HP 3326A ends a sweep normally. Reset when the HP 3326A is preset or receives a device clear command, selected device clear command, or RST command.
B0	1	PROGRAM ERROR. Set when the HP 3326A receives an invalid HP-IB command (e.g. command syntax or incompatible command for mode selected). Reset when the HP 3326A is preset or receives a device clear command, selected device clear command, or RST command.

The new address will remain until changed by the operator because of the 3326A's non-volatile memory. However, should battery power be interrupted, the address will default to the factory preset address of 18.

INTERFACE FUNCTION CODES

SH1 Source Handshake—full capability
AH1 Acceptor Handshake—full capability

T6 Basic Talker—Serial Poll capability; no talk only
L4 Basic Listener—Unaddressed if addressed to talk; no listen only
SR1 Service Request—full capability
RL1 Remote Local—complete capability
PP0 Parallel Poll—no capability
DC1 Device Clear—full capability
DT1 Device Trigger—full capability
C0 Controller—no capability
E1 Driver Electronics—open collector

Table 3: Error Summary

ERROR#	FRONT PANEL ALPHA	ERROR DESCRIPTION
10	SNTX	Illegal HP-IB code syntax
11	RMOT	Front panel keypress in remote
12	LOCK	LOCAL key pressed in local lockout
20-29	RNGE	Entered parameter out of range
30	B FR	Channel B cannot track Channel A in Two-Tone/HV on
40-49	INTR	Cannot interrogate or display parameter
50	CNVT	Units conversion rounded to zero
60-69	SUFx	Illegal units terminator
70	INC	Entry increment value or terminator error
80	AMPL	Incompatible with amplitude
86	MODL	Incompatible with modulation
87	MODE	Incompatible with mode
88	FREQ	Incompatible with frequency
89	CMBR	Incompatible with combiner
90	SWFR	Start and stop frequencies equal
94	DUTY	Pulse duty cycle too narrow
95	SWFR	Illegal sweep frequencies for HV option
96	SWFR	Illegal sweep frequency for internal modulation
100	RATE	Illegal sweep rate
110-114	DSWP	Illegal discrete sweep due to mode or lack of elements
115	DSHV	Illegal discrete sweep frequency with HV option
116	DSML	Illegal discrete sweep frequency with modulation
117	DSMD	Mode changed after discrete frequency sweep elements entered
120	P OF	Cannot clear Channel A Phase Offset
130-139	H V	Cannot program High Voltage option
140	CSUM	Checksum error indicates bad instrument state
150		Requested state is incompatible
160	CRPT	Corrupted power-on state is preset
170	A OL	Channel A overloaded
171	B OL	Channel B overloaded
172	SYOL	Sync output overloaded
173	AVCO	Channel A VCO unlocked
174	BVCO	Channel B VCO unlocked
180	XREF	External Reference unlocked
190	MCAL	Internal AM or PM cal unsuccessful
191	PCAL	Phase cal unsuccessful
192	ACAL	Amplitude cal unsuccessful
193	OCAL	DC Offset cal unsuccessful
194	OCAL	Residual Offset cal unsuccessful
300-399	FAIL	Self Test Error Codes

Table 4: Alphabetical Listing of HP-IB Codes

MNEMONIC DESCRIPTION	
AC	* Calibrate
ACAL	Auto Calibration
AEA	A External AM modulation
AEP	A External PM modulation
AIA	A Internal AM modulation
AIP	A Internal PM modulation
AM	Amplitude
AP	* Assign Zero Phase
BEA	B External AM modulation
BEP	B External PM modulation
BUSM	Bus Mode
CAL	Calibrate
CF	Set Sweep Center Frequency
CFM	Marker to Center Frequency
CHA	Select Channel A
CHB	Select Channel B
CMB	Combiner Enable
CMD	Calibration Mode
COF	Clear Phase Offset (Ch B)
DB	* dBm
DBM	dBm
DBV	dBV
DC	DC Function Selection
DE	* Degrees
DEG	Degrees
DISP	Display Blank
DN	Step Down/Decrement Value
DRCL	Discrete Recall Element
DRST	Discrete Reset Elements
DSAV	Discrete Save Element
DSCR	Discrete Sweep Mode
DUTY	Duty Cycle
EINC	Set the entry-increment value
ER?	* Output Error Number
ERR?	Output Error Number
EXT	External Calibration mode
FCNA	Set Channel A Function
FCNB	Set Channel B Function
FR	Frequency
FU	* Function of selected channel
HV	* High Voltage of selected channel
HVA	High Voltage A
HVB	High Voltage B
HZ	Hz
ID?	Output Instrument ID
INT	Internal Calibration Mode
KH	* kHz
KHZ	kHz
LRN	Output Learn String
MA	* External AM of selected channel
MASK	Request Mask
MD	* Bus Mode
MF	Sweep Marker
MFY	Modify on/off
MH	* MHz

MNEMONIC DESCRIPTION	
MHZ	MHz
ML	Modulation Level (% AM or PM Deviation)
MODE	Mode
MP	* External PM of selected channel
MR	* mV RMS
MS	milliseconds
MULT	Multiphase Calibration Mode
MV	* millivolts peak-to-peak
NOM	No modulation
OF	DC Offset
OFF	Off
ON	On
PC	Percent
PH	Phase
PRG	Program Learn String
PULS	Pulse Mode selection
RAMP	Ramp Sweep Mode
RCL	Recall Register
RDY?	Output Ready Status
RE	* Recall Register
REV?	Output Revision Number
RST	Instrument Preset
SAV	Save Register
SC	Sweep Continuous
SEC	Seconds
SER?	Output Serial Number
SIN	Sine Function selection
SM	Sweep Mode
SP	Sweep Stop Frequency
SPAN	Set Sweep Span
SPE	Synchronous Phase External modulation
SQR	Square Function selection
SR	* Save Register
SRE	Sweep Reset
SS	Sweep Single
ST	Sweep Start Frequency
STC	External Triggered Continuous Sweep
STIM	Sweep Time
STS	External Triggered Single Sweep
TDN	External Triggered Decrement Value
TE	* Self Test
TI	* Sweep Time
TOFF	External Trigger no action
TRGL	Triangle Sweep Mode
TST	Self Test
TUP	External Triggered Increment Value
TWOC	Two-Channel Mode selection
TWOP	Two-Phase Mode selection
TWOT	Two-Tone Mode selection
UP	Step Up/Increment Value
VO	Volts peak-to-peak
VR	* V RMS
VRMS	V RMS
WAIT	Wait
ZPH	Zero Phase

* This is an HP 3325A HP-IB mnemonic that is totally compatible and accepted by the 3326A. Some may require specifying which channel is to be affected by the command.